

Building Performance Improvement Board

1/4/2023

Agenda

- Administrative items
- Recap actions from previous meeting
- Site EUI Target setting discussion focus on Zero Net Carbon Compatible target
 - Technical feasibility (slides: 20 mins, discussion: 20 mins)
 - Economic impacts (slides: 15 mins, discussion: 25 mins)
 - Existing incentives (slides: 15 mins)
 - Discussion (20 mins)



Administrative Items

Actions

Approve meeting notes



Previous Meeting Recap

ZNC Target Overview

- Technically feasible limit on site EUI that models energy efficiency + efficient electrification of end uses.
- EUI is reduced through efficiency AND electrification measures.
- Provides largest on-site (direct) and total carbon reduction, especially as grid decarbonizes.
- Higher up-front costs and potentially longer payback, with more limited options in many cases electrification is necessary to reach the target.
- Most aligned with state net zero direct emissions goals.

Action Items

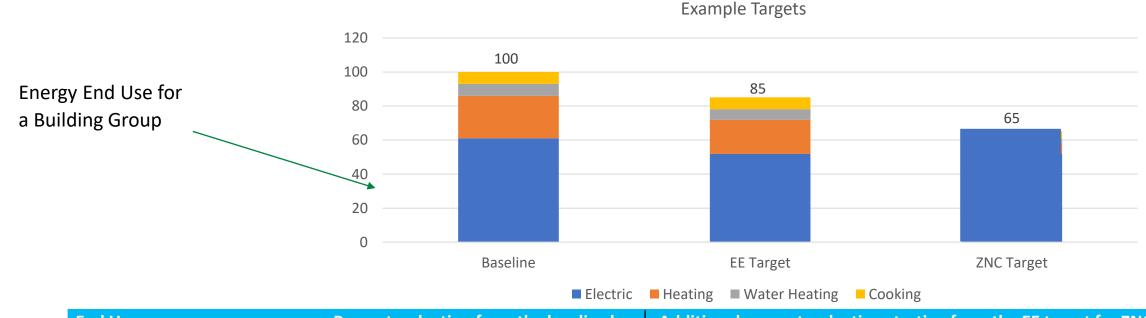
- Members asked to look at the current site EUI of a sample of buildings in the county, for instance DEP's headquarters and other, newer buildings to see how close they are to the ZNC target.
 - Spreadsheet with individual building site EUI from CY 2021 benchmarking data emailed.
 - A few summary slides reviewed in "technical feasibility" section below



ZNC Target: Technical Feasibility

Site EUI Target Methodology

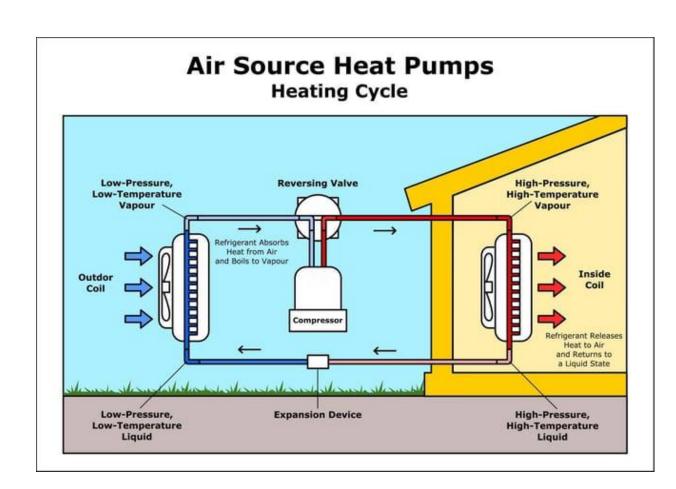
- We can estimate the typical energy end uses for each building type group
- From there, apply standard reduction targets to different end uses based on what is achievable through energy efficiency (EE target) or energy efficiency + electrification (ZNC target) for each end use to arrive at whole-building site EUI targets
- Heat pumps move heat instead of creating it so operate at higher efficiencies thus greatly reducing site kBtu



End Use		Percent reduction from the localized	Additional percent reduction starting from the EE target for ZNC	
		median EUI for EE target	target	
	Electricity	15%	0% (no further change)	
	Gas Space Heating	20%	68%, all electric (COP* 0.80 → 2.50)	
	Gas Water Heating	10%	59%, all electric (COP 0.90 → 2.20)	
	Gas Cooking	0%	39%, all electric (COP 0.45 → 0.74)	
	Gas Laundry/Other	0%	11%, all electric (COP 0.90 → 1.00)	

Why are heat pumps more efficient?

- One of the main reasons heat pumps are so energy efficient that they do not generate heat on their own, they simply move it from one place to another: air-source heat pump (from/to air), ground-source heat pump (from/to ground), water-source heat pump (from/to water).
- In the winter, the pump extracts heat from the outdoor air (or ground or water) using refrigerant and distributes it inside. In the summer, hot air from inside is removed. Helpful overview.
- COP is the Coefficient of Performance of the equipment, defined as energy output (heat) divided by purchased energy input (gas or electricity).
 - The most efficient combustion systems can approach efficiencies of 100%.
 - A heat pump can operate at efficiencies of 250% or greater (COP of 2.50) by extracting heat from the outside air.

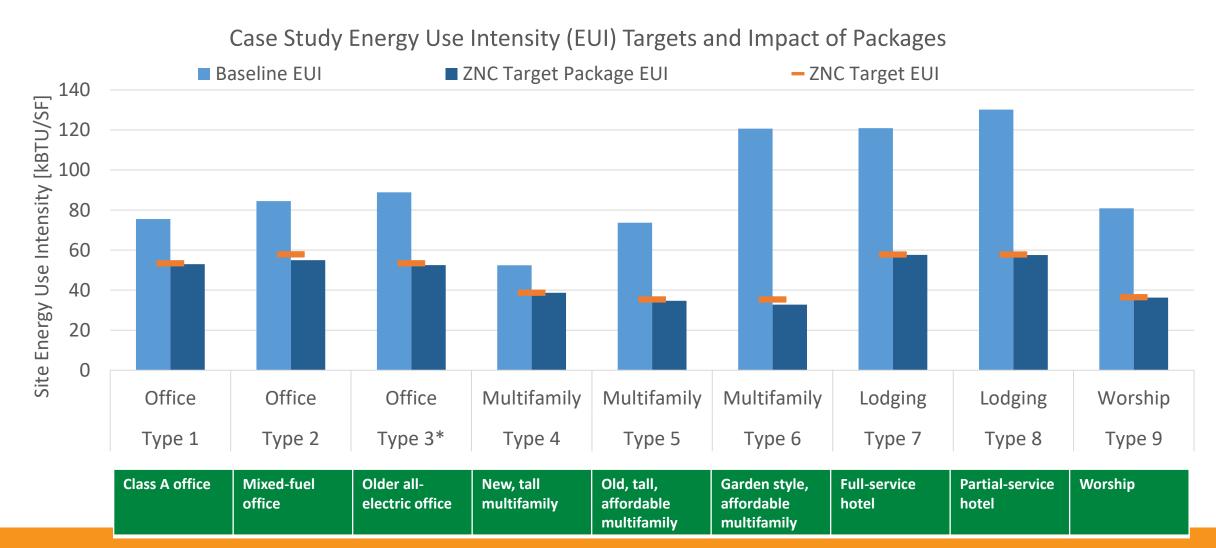


BEPS Technical Report Case Studies

- Case studies looked at 9 real buildings in common building types that were above proposed EE and ZNC targets
- Created EEM packages from virtual audits to evaluate technical feasibility and rough, estimated costs to reach targets
- Included:
 - Class A office
 - Mixed-fuel office
 - Older all-electric office
 - New, tall multifamily
 - Old, tall, affordable multifamily
 - Garden style, affordable multifamily
 - Full-service hotel
 - Partial-service hotel
 - Worship

Impact: Case Study Buildings – Technical Feasibility Test

• In all case studies, the ZNC target was technically achievable with existing technology and systems through a combination of energy efficiency, electrification, and on-site solar PV (via a Renewable Energy Allowance)



BEPS Technical Report Case Studies – Common EEMs

	HVAC Schedule Adjustments	Adjust existing HVAC schedules to align with occupancy
O&M	Retro-commissioning	Retro-commission and implement improvements on central building systems
	Wider Deadbands	Expand deadbands for central mechanical equipment
	Add Programmable Thermostats	Add programmable thermostats to apartments, provide instructions to occupants on use
Controls	Electric Submetering	Install submeters to incentivize tenants to reduce their energy use
Controls	Guest Room Controls	Add automatic guest room controls to limit extra energy usage during unoccupied times
	Plug Load Management	Install smart plug load management tools
	Daylighting Controls	Install daylighting sensors to turn off lights in perimeter spaces
	Finish LED Conversion	Convert the remaining lighting systems to LED
Lighting	Finish LED Conversion	Complete ongoing LED conversion
Lighting	Garage LED upgrade	Complete ongoing LED conversion for the parking garage
	Lighting Occupancy Presence Sensors	Install lighting sensors to sense occupants in offices
Water	High-Efficiency Water Aerators	Install high-efficiency aerators in faucets and showers
Solar	Solar PV	Install roof-mounted solar PV
Sulai	Solar PV	Install canopied solar PV

BEPS Technical Report Case Studies – Common EEMs

	Booster Pump VFDs	Install variable frequency drives on domestic water booster pumps
	Central Plant Pump VFDs	Install variable frequency drives on central distribution pumps
	Cooling Tower Fan VFDs	Install cooling tower fan variable frequency drives
	CW Pump VFDs	Install condenser water pump variable frequency drives
HVAC	Loop Pump VFDs	Install VFDs on the loop pumps
	Convert to VRF System	Convert the mechanical system to a VRF system
	Install ERV	Install an exhaust recovery ventilation unit
	Pneumatic Conversion to DDC	Convert central plant pneumatics to DDC and calibrate/optimize system
	Recommission Heat Recovery	Recommission existing heat recovery ventilation system
Envelope	General Air Sealing	Air seal gaps in masonry, between window/wall sealing, doors, and other envelope
	DOAS Conversion to Electric	Install a dedicated electric outdoor air system with heat recovery capabilities
	Electrify DHW	Convert domestic hot water gas heating to electric air-to-water heat pump systems
	Electrify Restaurant	Convert gas cooking to electric cooking
	Electrify Space Heating	Convert the central boiler to an air-to-water heat pump
Electrification	Electrify Space Heating	Convert the central mechanical system to an air-to-water heat pump system
	Electrify Space Heating	Convert the central mechanical system to a ductless split heat pump system
	Electrify Space Heating	Convert existing HVAC system to an electric heat pump system
	Electrify Space Heating	Convert existing gas heating system to an electric heat pump system
	Electrify Water Heating	Convert existing DHW system to electric DHW

Countywide Savings Needs

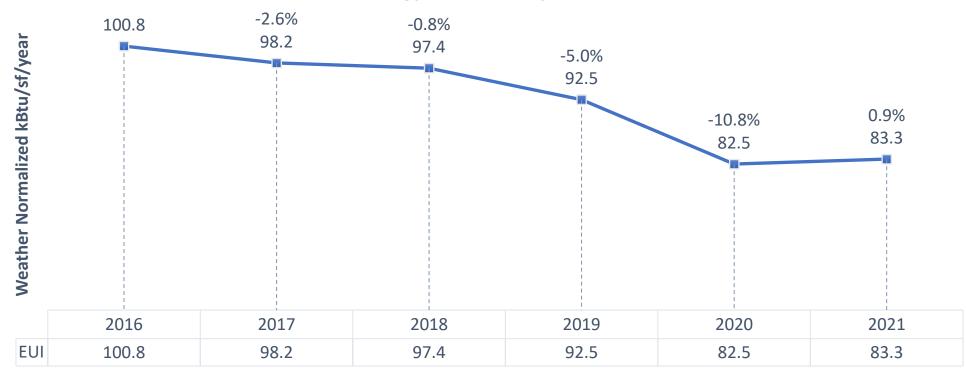
- On average, buildings need to reduce site EUI 35% from baseline by end of final target year; 3.5% from the baseline on average, year over year for 10 years.
- The average savings may be higher or lower between building groups depending on existing end uses.

	EE	EE-ZNC midpoint	ZNC
Reduction in Site EUI vs baseline	23%	28%	35%
Reduction in On-site Fossil Fuel Emissions	46%	66%	86%
Reduction in emissions vs baseline (NO change from today's grid)	19%	22%	26%
Reduction in emissions (carbon free electric supply)	87%	92%	97%

Site EUI Trends

- County results mirror <u>EPA research</u> that shows persistent energy savings in benchmarked properties (non-residential 50k+ gsf)
- Benchmarking data for consistently reported properties shows:
 - ♣ 17.3% decrease in site EUI between 2016 and 2021, or an average of 3.5% per year
 - 8.2% decrease in site EUI between 2016 and 2019 (pre-COVID), or an average of 2.7% per year

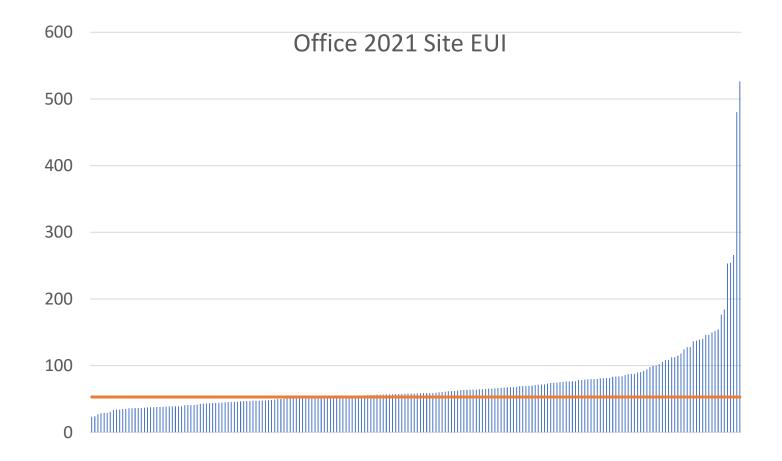
Site Energy Use Intensity Over Time



Benchmarking Data vs. ZNC Target

• Many high EUI "offices" contain high intensity secondary space like labs or data centers

Office	
% of covered buildings	31%
% of buildings meeting	
ZNC target (based on	
2021 data)	36%
Average reduction	
needed to reach ZNC	
Target (from BEPS	
Technical Report)	16%

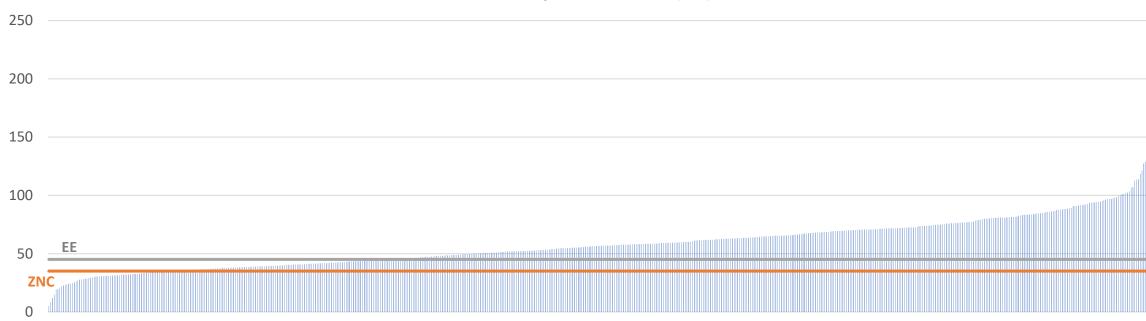


Benchmarking Data vs. ZNC Target

Multifamily buildings tend to have more gas use, and thus higher site EUI reduction potential

Multifamily	
% of covered buildings	34%
% of buildings meeting ZNC target (based on 2021 DC data)	11%
% of buildings meeting EE target (based on 2021 DC data)	31%
Average reduction needed to reach ZNC Target (from BEPS Technical Report)	44%







ZNC Target:Costs

Costs in BEPS Technical Report

- Total capital cost does not include avoided cost from the replacement of existing equipment
- Cost does not include financial assistance available for energy efficiency retrofits
- Cost savings assume flat rates for natural gas and electricity
 - \$0.129 / kWh for electricity
 - \$1.228 / therm for natural gas
- Costs estimated for countywide implementation
- Costs estimated in 9 case study buildings which were selected because in most cases they would have significant work to do to reach the EE or ZNC target (so costs are higher than the countywide averages)

Impact: County-Wide Estimated Financial Costs and Savings

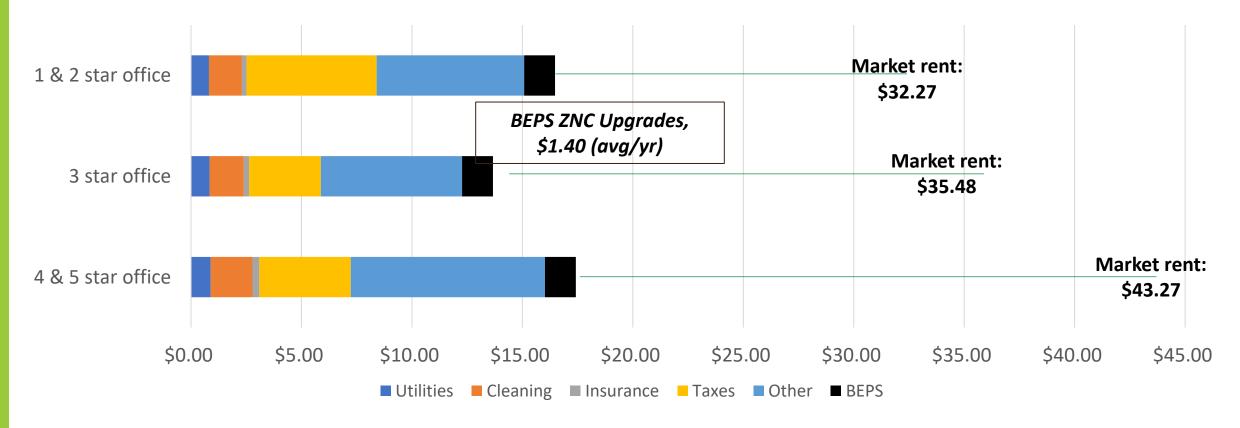
Costs = full cost of new system, <u>not</u> incremental cost above standard replacement.

	No BEPS	ZNC	
Energy Costs (annual, post-BEPS)	\$543	\$437	Million
Energy Cost Savings (annual, post-BEPS vs baseline)	\$0	\$106	Million
% Energy Cost Savings (annual, post-BEPS vs baseline)	0%	19%	% lower than baseline
BEPS Related Capital Cost \$/SF (average, total cost)	\$0	\$13.90	\$/SF
BEPS Related Capital Cost* / SF / year (annual average over <u>10</u> years)	\$0	\$1.40	\$/SF/year

Some major in-building equipment (i.e., mechanical equipment) is likely to be replaced prior to the BEPS final target date. This capital cost can be redirected toward deeper retrofit projects. This creates a lower "effective" cost of compliance, but baseline capital costs are highly building dependent on factors outside of the study. <u>Baseline capital cost outlay, financial incentives, and financing were too building-specific to determine, and thus, are not</u> included in this report. 23

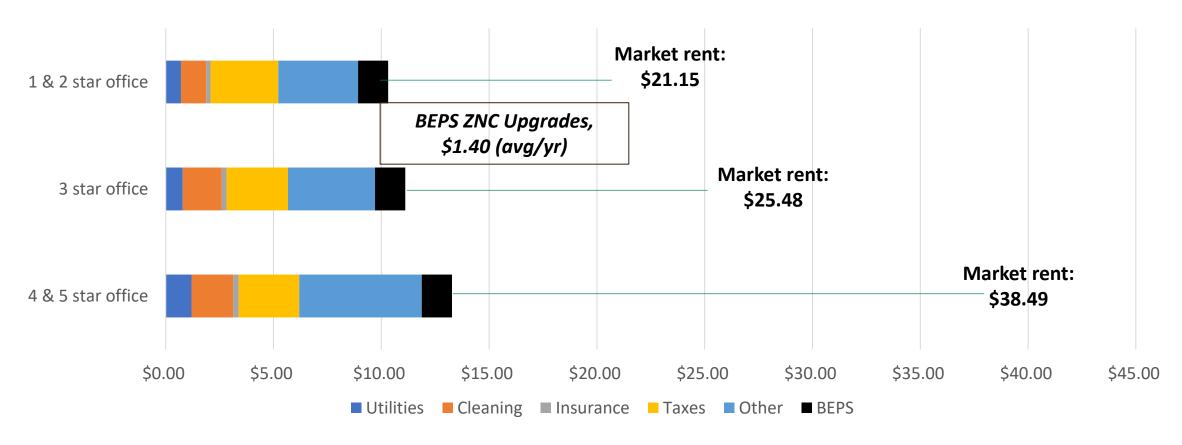
BEPS Related Capital Costs / SF in Context

- Costar market reports show annual expenses per square foot as well as rental income per square foot
- Report (accessed 1/3) shows total average rental income for **Bethesda/Chevy Chase offices**: \$40 per square foot
- Operating expenses per square foot are ~\$12-16 per square foot



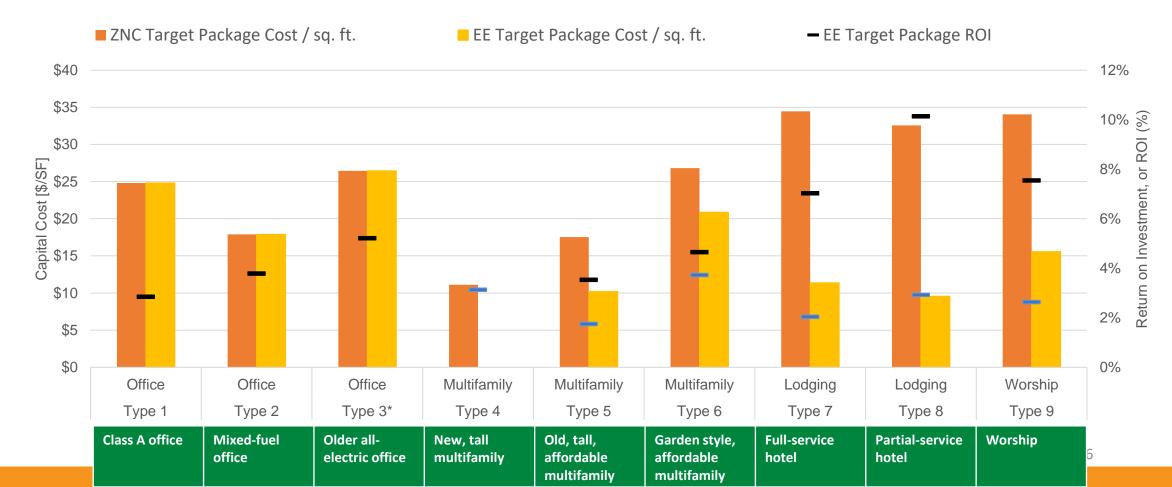
BEPS Related Capital Costs / SF in Context

- Costar market reports show annual expenses per square foot as well as rental income per square foot
- Report (accessed 1/3) shows total average rental income for **Gaithersburg offices**: \$28.78 per square foot
- Operating expenses per square foot ("I-270 Corridor") are ~\$9-12 per square foot



Impact: Case Study Buildings – Costs/Benefits

- The ZNC target packages delivered a positive return on investment for all case-study buildings, though with long simple payback
- Costs tended to be higher than average given case study buildings' need for significant savings
- Costs = full cost of new systems over whole BEPS period, <u>not</u> incremental cost above standard replacement, do not factor in incentives, and do not forecast future utility rates or potential penalties



Impact: Case Study Buildings – Costs/Benefits

- The ZNC target packages delivered a positive return on investment for all case-study buildings, though with long simple payback
- Costs tended to be higher than average given case study buildings' need for significant savings
- Costs = full cost of new systems over whole BEPS period, <u>not</u> incremental cost above standard replacement, do not factor in incentives, and do not forecast future utility rates or potential penalties

	ZNC
Cost* per square foot	\$11 - \$34 Average: \$25
Annual savings per square foot	\$0.30 - \$1.50 Average: \$0.77
Simple Payback	19 – 57 years <i>Average: 32 years</i>
Return on Investment	2% – 5% Average: 3%

Simple payback = total project cost divided by the energy cost savings per year. Equates to the number of years until the annual cost savings "pay back" the up-front investment

Return on Investment (ROI) = energy cost savings per year divided by the total cost, converted to a percentage. Equates to the percentage return of a particular investment.



Existing Incentives

Available Incentives



County Tax Incentives

 New energy performance tax credit for new and existing buildings



EmPOWER MD

incentives

 Staff O&M training, building tune ups, rebates





Financing and technical assistance offered by

Montgomery County Green

Bank and MD Clean Energy

Center



MEA programs

Grants, financing, CHP, EV charging, solar, resiliency hubs



Federal Incentives

 Tax credits/deductions (179-D, ITC, etc)

EmPOWER MD Incentives - Electric

Prescriptive incentives

• Lighting, HVAC, controls, VFDs, commercial kitchen

Building Tune Up

- Help determine the energy performance of facilities and identify energy saving opportunities by optimizing their existing systems. Primary focus on HVAC and control systems for cost-effective savings opportunities
- 75% of project cost, capped at \$0.20/kWh saved annually and \$200,000 per project

Monitoring-Based Commissioning

- Phase I installation of automated remote monitoring and diagnostic equipment. 25% of the 18-month monitoring contract cost capped at a maximum of \$8,000 and \$0.04 per conditioned square foot for the ASHRAE Level II Energy Audit (if provided).
- Phase II monitor for at least 6 months and create MBCx Equipment Monitoring Report
- Phase III implementation of O&M measures recommended. A one-time incentive of \$0.17 per kWh saved annually for all measures that are approved, implemented, and completed.

Custom incentives

- Measures combined must save a minimum of 25,000 kWh/year of electric energy
- \$0.25/kWh for the first year of projected kWh savings, capped at 50% of total project cost (labor and materials)

O&M Training

• Incentives covering 80% of the cost of training for contractors and building operation personnel, up to \$1,000

EmPOWER MD Incentives - Gas

Prescriptive incentives

Heating, hot water heating, boilers, food service, washer/driers, pool heating

HVAC Tune Up

Pipe/water heater wrapping and set back

Custom incentives

- Up to \$3.70/therm, capped at 50% of the total costs for the more efficient equipment.
- Paused as of October 18, 2022 due to limited funding following higher than anticipated program participation

Case Study Measures and EmPOWER Incentives

- ICF completed an <u>Addendum to the BEPS Technical Report</u> that evaluated incentive potential of case study buildings' EEMs based on current EmPOWER MD incentives
 - Retro-commissioning (RCx) and Building Tune-up project measures tend to benefit the most from incentives.
 - The next most attractive measures tend to be plug load management and lighting retrofit measures. Depending on the baseline condition and building type, incentives often cover 30-40% of the cost to implement.
 - Variable frequency drive retrofit projects are also attractive for incentives, covering around 20-25% of the cost.

• Many of the electrification recommendations tended to benefit the least from incentives as <u>currently</u> designed under the current EmPOWER

funding cycle

	ZNC Cost/Sq Ft (Total)	After Utility Incentives
Countywide Estimate	\$13.90	\$12.93
Case Study Buildings Estimate	Average: \$25	\$23.25

Case Study	% of ZNC package costs offset by incentives
1: Class A Office	5% - 6%
2: Older Mixed Fuel Office	6% - 7%
3: Older All-Electric Office	7% - 8%
4: New High-Rise Mixed-Use Multifamily	5% - 6%
5: Old High-Rise Affordable Multifamily	7% - 9%
6: Garden-Style Multifamily	4% - 7%
7: Mid-Sized Hotel w/ Conference Space	8% - 9%
8: Standard Hotel w/ Extra Space	8% - 10%
9: Worship/Education Mixed-Use	4% - 5%
WEIGHTED AVERAGE	7%

EmPOWER MD Incentives – Future?

- PSC EmPOWER MD Future Programming Working Group meeting now to deliberate on what incentives will be included in the 2024-2026 EmPOWER cycle
 - Performance metric for counting savings?
 - Fuel switching?

Federal Tax Credits

- Inflation Reduction Act (IRA) expanded 179-D
 - Starting in 2023, the base deduction rate starts at \$0.50/sf for 25% improvement against the building's own pre-retrofit site energy usage intensity and increases incrementally **up to** \$1.00/SF for 50% improvement.
 - A bonus deduction is available for projects meeting prevailing wage and apprenticeship requirements. This bonus deduction starts at \$2.50/SF and increases 10 cents for each percentage improvement up to \$5.00/SF for 50% improvement.
 - Three-year cap, meaning a building can be eligible for the 179D deduction every three years assuming at least one of the systems contributing to energy efficiency has been properly renovated.
 - Now applicable to real estate investment trusts and certain tax-exempt entities who can allocate the deduction to the "designers"

Federal Tax Credits - ITC

Updates to Energy Investment Tax Credit (48 ITC)

- Long-standing tax credit for private and non-taxable entities
- Historically for qualified "energy property,"
 incl: solar, geothermal heat pumps, combined heat and power, and more

Key Changes from the IRA:

- Tax credits of up to 50% of the cost for energy property projects
- Expanded to <u>addt'l</u> technologies, incl. thermal energy storage property defined as property comprising a system which:
 - (I) is directly connected to a heating, ventilation, or air conditioning system,
 - (II) removes heat from, or adds heat to, a storage medium for subsequent use, and
 - (III) provides energy for the heating/cooling of the interior of a residential/commercial building
- Timeframe base credit rates apply:
 - Thermal energy storage: 12/31/2022-12/31/2024
 - Geothermal heat pumps: phase out from 6%-4.4% from 12/31/2021-1/1/2035

Updated Energy Investment Tax Credit		
Base Rate	6%	
Increased Credit Amount*	Up to 30%	
Meets Domestic Content Requirements**	2%-10%	
Meets Energy Communities Requirements***	2%-10%	
Total Potential Credit Value	Up to 6% Base + Up to 50% Bonus	

179D vs Estimated Costs

- Assuming an average savings of 35%, the average building would be eligible for a \$3.50/sf max tax deduction
- Case study buildings averaged 50% savings, making them eligible for a \$5.00/sf max tax deduction
- Condo owners may be eligible for High-Efficiency Electric Home Rebate program (for LMI) or Energy Efficient Home Improvement credit (capped at \$2k)

	ZNC Cost/Sq Ft (Total)	After Utility Incentives	After 179D
Countywide Estimate	\$13.90	\$12.93	\$9.43
Case Study Buildings Estimate	Average: \$25	\$23.25	\$18.25

Property Tax Credits

County Tax incentives

- New energy performance tax credit for new and existing buildings
- Up to 100% deduction in property taxes. If awarded, the property will receive a credit granted
 against the county taxes owed for two (2) years.
- Two-tiered incentive for measured performance and green building certification in new or existing buildings
 - 1st Tier Earn an incentive for a measurable reduction in energy use:
 - Existing buildings must demonstrate improved energy performance using Portfolio Manager.
 - Buildings located in <u>Equity Emphasis Areas</u> receive an additional 10% credit.
 - **2nd Tier** Once 1st tier is met, earn additional credit for achieving a certain level of building certification:
 - Third-party certifications broadened beyond LEED; includes BREEAM, PassiveHouse, Living Building Challenge, other robust, third-party certification systems that strive for net-zero buildings.

County Property Tax Credit vs Estimated Costs

- Buildings assessed a County property tax credit rate per \$100 of assessed value, making average property tax credit potential difficult to estimate on a square footage basis
- Not applicable to tax exempt entities; not applicable to condo buildings without a shared tax basis
- Likely no more than \$1/sf max, for 2 years

	ZNC Cost/Sq Ft (Total)	After Utility Incentives	After 179D	After Property Tax Credit
Countywide Estimate	\$13.90	\$12.93	\$9.43	<i>\$7.43?</i>
Case Study Buildings Estimate	Average: \$25	<i>\$23.25</i>	\$18.25	\$16.25?

Montgomery County Green Bank

Financing

- Commercial Loan for Energy Efficiency and Renewables (CLEER)
 - Funds for commercial and industrial (C&I) property owners, including nonprofits, common ownership community associations, and multifamily properties.
 - 100% financing; Can include up to 30% of costs for other improvements
 - Can make projects cash flow positive
- Commercial Property Assessed Clean Energy (C-PACE)
 - 100% upfront, 20-year financing, debt service paid through surcharge on property tax bill
- Commercial Solar PV Renewable Energy Power Purchase Agreement (CSPPA)

Technical Assistance

Providing subsidized energy audits

Montgomery County Green Bank

Melvin J. Berman Hebrew Academy

- 258,000 sq ft private school facility in Rockville, MD currently operating off an HVAC system from 1999
- Replace and upgrade 59 rooftop HVAC units + connect to updated Building Automation System for monitoring and automation
 - EmPOWER incentives for equipment + Monitoring Based Commissioning
- Loan amount: \$2,500,000 Small Business Energy Savings Support loan
- Projected savings: At least 20% energy savings, \$96,000 per year.
- An interest-only loan period will allow the Academy to make the required upgrades while preserving reserves and revenue streams.
 After the two-year interest only period, the loan will convert to a 10year term with a 20-year amortization with the monthly payments covered by improved energy savings.



Maryland Energy Administration

- <u>Commercial, Industrial & Agricultural Energy Efficiency Program</u>: The CI&A Program provides grants to Maryland businesses and nonprofit organizations for the installation of comprehensive energy efficiency improvement projects that reduce their baseline consumption. This can be reduced kWh, reduced fuel usage, or a combination thereof. Incentives are awarded in tiers based upon the amount of savings achieved. Applications are awarded on a **first-come**, **first-served basis** through **February 15**, **2023** for the FY23 funding round.
- <u>Jane E. Lawton Conservation Loan Program</u>: The Lawton Loan program provides low-cost loans to Maryland businesses, nonprofit organizations, local governments, and other State government agencies for energy efficiency and energy conservation improvement projects. All of the measures covered by the CI&A program are eligible under Lawton, plus combined heat and power (CHP). Interest is 1% for businesses and nonprofits, and there is no interest for local governments and other State government agencies. It accepts applications on a **rolling basis**, and loans are made based upon eligibility compliance and funding availability.
- Resilient Maryland Program: Resilient Maryland provides preconstruction planning as well as equipment and installation grants for microgrids and other resilient energy systems, including resiliency hubs. This omnibus resiliency program is designed as a lifecycle platform incentive program to provide grant funds for projects from inception through construction, based upon where they are in the process at the time of application. This is a **competitive program** and applications are being accepted until **January 26, 2023.**
- <u>Combined Heat and Power (CHP) Grant Program</u>: The CHP program provides grants to Maryland organizations for the installation of CHP systems to improve the energy efficiency, sustainability, resilience, and energy affordability of their facilities. Applications are accepted on a **first-come**, **first served** basis and were due by, December 15 for the FY23 round. Uncertainty about availability of an FY24 program until the General Assembly approves our budget for the FY24 year during the first quarter of 2023.

Discussion

- ZNC Target Recap:
 - Members favored aligning site EUI target with state decarbonization goals
 - ZNC Target requires largest reduction in site EUI (and direct GHG emissions)
- What are the remaining concerns about using ZNC as the site EUI target?
- What additional information is needed?
- Next steps?

Next Steps

- Extensions and adjustments for under-resourced buildings
- Renewable Energy Allowance
 - May make it easier to reach the County's BEPS providing a "credit" for renewable energy
- Building Performance Improvement Plans
 - Need to determine criteria under which a BPIP will be allowed "financial infeasibility" and circumstances outside of an owner's control
 - Need to determine implementation requirements "cost effective" measures

Helpful Links

- Benchmarking and Performance Standards Law
- Benchmarking Website
- BEPS Website
- <u>Building Performance Improvement Board Website</u> (will include agendas, notes, and presentations)
- <u>BEPS Stakeholder workgroup + report</u> completed before bill was introduced to gather stakeholder input on BEPS policy elements
- <u>BEPS Technical Report</u> outlines options for site EUI targets by building type group and assesses feasibility and costs in representative case study buildings
 - <u>Presentation</u> of BEPS Technical Report to Council Transportation & Environment Committee
- <u>Allowance for Renewable Energy Technical Report and Recommendations</u> provides information on determining how a renewable energy allowance should be defined and implemented within BEPS regulations
- On weather and business normalization:
 - EPA technical reference guide on weather normalized energy use
 - <u>EPA's Recommended Metrics and Normalization Methods for Use in State and Local Building Performance</u> <u>Standards document</u>

Helpful Links (continued)

- Maryland Clean Energy Center 10/25 Webinar, Solutions to Achieve Building Energy Performance Standards recording
- Maryland Department of Environment BEPS page

Questions?

Emily Curley

Building Energy Performance Programs Manager Emily.Curley@MontgomeryCountyMD.gov

240-777-7707

BPIB Webpage

https://www.montgomerycountymd.gov/green/energy/bpib.html

Stay Informed

Check BEPS website for real-time updates:

https://www.montgomerycountymd.gov/green/energy/beps.html

Sign up for Commercial Energy Newsletter

